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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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09/703,423

11/01/2000

Antonio J. Colmenarez

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06/10/2004

PHILIPS INTELLECTUAL PROPERTY & STANDARDS

P.O. BOX 3001

BRIARCLIFF MANOR, NY 10510

EXAMINER

LU, TOM Y

ART UNIT

PAPER NUMBER

2621

DATE MAILED: 06/10/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/703,423

Applicant(s)

COLMENAREZ ET AL.

Examiner

Tom Y Lu

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 07 May 2004.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-21 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☒ Claim(s) 15-17 is/are allowed.
- 6) ☒ Claim(s) 1-14 and 18-21 is/are rejected.
- 7) ☒ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
 - ☐ Certified copies of the priority documents have been received in Application No. _____.
 - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date _____
- 4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____

DETAILED ACTION

Response to Amendment

1. Upon entry of Request for Continued Examination filed on May 07, 2004, the amendment filed on April 02, 2004 has been entered.
2. Claims 1-21 are pending.

Response to Arguments

3. Applicant's arguments, see Remarks, pages 8-10, filed on April 02, 2004, with respect to the rejection(s) of claim(s) 1, 20 and 21 under 35 U.S.C. 103 (a) have been fully considered and are persuasive. Therefore, the rejection has been withdrawn. However, upon further consideration, a new ground(s) of rejection is made in view of Colmenarez et al ("Embedded face and facial expression recognition", Image Processing, 1999. ICIP 99. Proceedings. 1999 International Conference on, Volume: 1, 1999 Pages: 633 - 637 vol.1).

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

4. Claims 1-3, 5-8 and 18-21 are rejected under 35 U.S.C. 102(b) as being anticipated by Colmenarez et al ("Embedded face and facial expression recognition", Image Processing, 1999. ICIP 99. Proceedings. 1999 International Conference on, Volume: 1, 1999 Pages: 633 - 637 vol.1).

- a. Referring to Claim 1, Colmenarez discloses processing a sequence of images (“video sequence”, page 633, right column, lines 17-18) to generate a statistical model for each person to be tagged (page 634, left column, equation 2), the statistical model incorporating at least one appearance feature (“feature appearance”, page 633, right column, paragraph 5) and at least one geometric feature (“feature positions”, page 633, right column, paragraph 5”) of the tagged person; applying the model to at least one subsequent image in order to perform at least one of a detection operation, a location operation and a tracking operation for the tagged person (the statistical model is applied in facial expression recognition, which is a detection operation. Therefore, at least one of the alternative limitations is satisfied), wherein an optimum trajectory of movement (the optimum trajectory of movement in Colmenarez is the facial feature movement in the facial expression demonstrated by the movement of the mouth, eyes, and eyebrows in the facial expressions of figure 3, which the statistical model of the facial feature is maximized, see page 634, left column, equation 3) of a tagged person is maximized through linear transformation (transformation matrix T , page 635, left column, line 22); and controlling an action of the image processing system based on a result of the at least one operation (“facial expression” is the claimed “an action”, which is determined based on the facial recognition algorithm, page 635, right column, lines 12-24).
- b. Referring to Claim 2, Colmenarez discloses wherein the sequence of image comprises a video segment (page 635, right column, lines 7-11).
- c. Referring to Claim 3, Colmenarez discloses wherein the processing step further includes processing the sequence of images to generate a plurality of statistical models,

each of the models corresponding to a particular tagged person (page 635, right column, last full paragraph).

d. Referring to Claim 5, Colmenarez discloses wherein the geometric feature comprises at least one of a region shape and a region position for given one of a plurality of regions associated with the statistical model (page 634, right column, paragraph 2, position x_{ki}).

e. Referring to Claim 6, Colmenarez discloses wherein the statistical model is generated at least in part by segmenting a given image into a number N of different regions of similar appearance (Note the segmenting in figures 2 and 3. Note also that there are 2 (i.e. N) different regions for the eyes (similar appearance), 2 difference regions for the left eyebrow, 2 for the right eyebrow, etc).

f. Referring to Claim 7, Colmenarez discloses wherein the statistical model generated for a given person comprises a likelihood probability function, which indicates the likelihood that the person is present in a given image (page 634, see equation 2).

g. Referring to Claim 8, Colmenarez discloses wherein the likelihood probability function $P(I | \Omega)$ for person Ω is computed as $P(I | \Omega) = \sum_{r=1,2,\dots,N} P(R_r | \Omega) P(r | \Omega)$, where

R_r is a function of the at least one appearance feature and the at least one geometric feature, and r is an index identifying one of N regions of similar appearance within the image I (page 634, see equation 2, which is identical to the claimed function except for the specific symbol used).

h. Referring to Claim 18, Colmenarez discloses wherein the controlling step comprises generating an output of the image processing system based on the result of the

at least one operation (the facial expression of the person is determined, page 635, right column, paragraph 2).

i. Referring to Claim 19, Colmenarez discloses wherein the controlling step comprises altering an operating parameter of the image processing system based on the result of the at least one operation (the hidden variable ε , the operating parameter herein, is replaced by a hidden state in a HMM, which the variable is altered between facial expressions in a sequence of video frames, see page 636, right column, last paragraph).

j. With regard to Claim 20, all the limitations are addressed in Claim 1.

k. With regard to Claim 21, the only difference between Claim 1 and Claim 21 is Claim 21 calls for additional limitation of a storage medium for storing one or more programs, which Colmenarez teaches using a computer system to implement his invention, which inherently requires a storage medium for storing one or more programs.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

5. Claim 4 is rejected under 35 U.S.C. 103(a) as being unpatentable over Colmenarez in view of Darrell et al (U.S. Patent No. 6,188,777 B1). The arguments in Paragraph 4.a above as to the applicability of Colmenarez are incorporated herein. Colmenarez already discloses the appearance feature is incorporated into the statistical model. However, Colmenarez does not explicitly teach the appearance feature is at least one of a color feature and a texture feature.

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However, Darrell at column 4, lines 28-29, teaches using color detection and segmentation module to detect regions of fresh tone in a target region, the target region is a face, column 2, line 51. At the time the invention was made, it would have been obvious to a person of ordinary skill in the art to use the color feature as appearance feature. A person of ordinary skill in the art would have been motivated to do this because both Colmenarez and Darrell teaches using appearance features for facial recognition/tracking, and it would have been an obvious matter of design choice to use the color feature as appearance feature in Colmenarez since applicant has not disclosed that using a color feature would post any significant advantages and it appears that the facial recognition algorithm would perform equally well with any appearance feature.

6. Claims 9-14 are rejected under 35 U.S.C. 103(a) as being unpatentable over Colmenarez in view of Chang et al (U.S. Patent No. 5,999,651). The arguments in Paragraph 4.a above as to the applicability of Colmenarez are incorporated herein.

- a. Referring to Claim 9, Colmenarez discloses wherein the statistical model generated for a given person comprises a likelihood probability function $P(r_k | \varepsilon, \rho)$, where r_k is feature region as shown in figure 2, and ε is the claimed discrete variable used to capture local motion, and ρ is the person in the image. Although Colmenarez does disclose a linear transform matrix T at page 635, left column for local motion, Colmenarez does not explicitly teach a linear transformation that is used to capture global motion of a person in the image. Chang teaches predicting global motion by using a linear transformation (at column 4, line 28) before estimating local motion. At the time the invention was made, a person of ordinary skill in the art would have been motivated to

incorporate a linear transformation for global motion in a facial recognition model like Colmenarez's because Chang at column 4, lines 17-19 teaches global motion prediction provides a good initial estimate for the subsequent motion estimation algorithm, and it would be reasonable to a person of ordinary skill in the art to modify a system like Colmenarez's to obtain the global movement of a person's face in a sequence of video images before focusing on particular facial features to determine the facial expression.

- b. Referring to Claim 10, the combination of Colmenarez and Chang discloses wherein a location of the person is determined using the linear transformation (see Chang, column 4, line 29).
- c. Referring to Claim 11, the combination of Colmenarez and Chang discloses wherein a pose of the person is determined using the discrete variable ξ (see explanation in Claim 9 for discrete variable in Colmenarez, and the discrete variable is used to capture the local motion of the facial features, which determines the facial expression of a person, such as sadness, happiness ... etc, a facial expression is a pose).
- d. Referring to Claim 12, the combination of Colmenarez and Chang teaches wherein the linear transformation is used to obtain a sub-window of the image I that is invariant to rotation and scale (see figure 2 in Colmenarez and the explanation in paragraph e below).
- e. Referring to Claim 13, the combination of Colmenarez and Chang teaches wherein the linear transformation T is implemented using bilinear interpolation

technique with a reference point in the image, a rotation angle and a scaling factor (Chang in figures 1-2b teaches using two video frame to detect global motion, which uses a bilinear interpolation technique, and using affine motion correction to determine the rotation and scaling factor of the frame for motion error measure).

- f. Referring to Claim 14, the combination of Colmenarez and Chang teaches wherein the local motion is modeled using a discrete set of states $\{\xi_1, \xi_2, \dots, \xi_M\}$ of the variable ξ to capture M different poses of the person (see figure 3 in Colmenarez, Colmenarez discloses tracking six different facial expressions in a sequence of video images, each facial expression in an video image is a pose).

Allowable Subject Matter

7. Claims 15-17 are allowed.

The following is a statement of reasons for the indication of allowable subject matter:

Independent claim 15 defines a statistical model generated for a given person Ω and image I comprises a likelihood probability function $P(I|T, \xi, \Omega) = \sum_{pix \in I} P(pix|T, \xi, \Omega)$, where r is an index to regions of similar appearance and N is a total number of such regions, $r=1, 2, \dots, N$, and $P(pix|r, T, \xi, \Omega) = \max[P(pix|r, T, \xi, \Omega)P(r|\xi, \Omega)]$, where $P(pix|r, T, \xi, \Omega)$ is the probability of observing pixel pix assuming that it belongs to an r -th region of the model on a pose ξ , and $P(r|\xi, \Omega)$ is the prior probability of the region at that pose. This feature in combination with other features in Claim 15, which is the broadest allowable claim, is not taught or suggested by the art of record.

Claims 16-17 are dependent upon Claim 15.

Conclusion

8. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

- a. "Face detection with information-based maximum discrimination", *Colmenarez, A.J.; Huang, T.S.*; Computer Vision and Pattern Recognition, 1997. Proceedings., 1997 IEEE Computer Society Conference on , 17-19 June 1997. Pages: 782 – 787. see section 4, face detection system and figure 2.
- b. "A probabilistic framework for embedded face and facial expression recognition", *Colmenarez, A.; Frey, B.; Huang, T.S.*; Computer Vision and Pattern Recognition, 1999. IEEE Computer Society Conference on. , Volume: 1, 23-25 June 1999. Pages: 597 Vol. 1. see sections 2 and 3.
- c. "Mixtures of local linear subspaces for face recognition" *Frey, B.J.; Colmenarez, A.; Huang, T.S.*; Computer Vision and Pattern Recognition, 1998. Proceedings. 1998 IEEE Computer Society Conference on , 23-25 June 1998. Pages:32 – 37. see sections 3 and 4.
- d. "Detection and tracking of faces and facial features", *Colmenarez, A.; Frey, B.; Huang, T.S.*; Image Processing, 1999. ICIP 99. Proceedings. 1999 International Conference on , Volume: 1 , 1999. Pages:657 - 661 vol.1. see section 3 for global motion tracking.

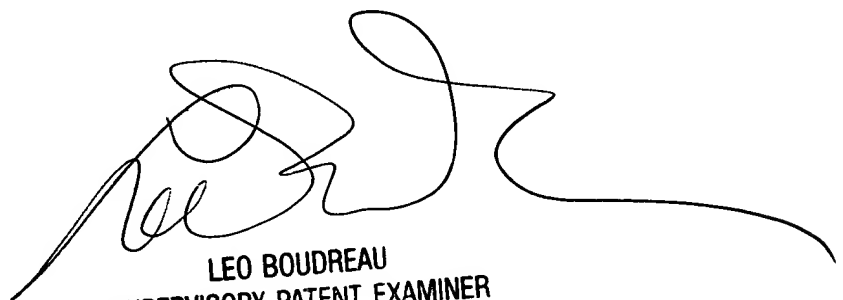
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9. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Tom Y Lu whose telephone number is (703) 306-4057. The examiner can normally be reached on 8:30AM-5PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Leo H Boudreau can be reached on (703) 305-4706. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

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